secretion. Now the chemical products which are phosphorescent at ordinary temperatures are not numerous; and the one of which one is led to think is phosphuretted hydrogen. It is for the chemists to elucidate this point; but, in consequence of the peculiarities just indicated, they must not attempt to ascertain its presence directly, but rather to see whether there are, in the cellular protoplasm of the apparatus, the materials necessary for the production of this gas.

What inclines me in favour of this hypothesis is the extreme resemblance that we observe between the phosphorescence of substances in decomposition, which is due to an evolution of phosphuretted hydrogen, and that of luminous animals. They present the same physical characters, the same affinity for oxygen, and only differ in this particular, that the cadaveric phosphorescence is continuous, like the decomposition of the substances which produce it, whilst the phosphorescence of the animals is intermittent. The latter is due to the fact that the cellular decomposition which sets free the luminous product, takes place in animals of high organization only under excitation of the nervous system, and in the lower animals (*Noctilucæ*) only by means of external excitants.

My investigations upon the glowworm and the experiments that I have made upon the *Noctilucæ* lead me to regard phosphorescence as a general property of protoplasm, consisting in an evolution of phosphuretted hydrogen. This mode of looking at it easily explains how many of the lower animals, although destitute of a nervous system, are phosphorescent. Further it presents the advantage of enabling us to connect the phenomena of phosphorescence observed in living creatures with those which are observed in organic matters in course of decomposition. It is another example of a biological phenomenon very clearly reduced to an exclusively chemical cause. —*Comptes Rendus*, February 16, 1880, p. 318.

### *On the French Jurassic* Cidaridæ.
By M. G. Cotteau.

M. Cotteau, having completed the revision of the Jurassic Cidaridæ in the 'Paléontologie Française,' has communicated to the Geological Society of France an interesting summary of his results. Of French fossil urchins he refers to this family 121 species, of which 87 belong to the old genus *Cidaris*, 25 to *Rhabdocidaris*, and 9 to *Diplocidaris*. The 121 species all belong to the Jurassic epoch: none of them existed before it; and none occur in the Cretaceous deposits. Most of them are also limited to a single stage of the Jurassic.

The Rhætic stage contains a single peculiar species. The Sinemurian (Infra-Lias) has 7 peculiar species, mostly represented by detached spines. The Liassic stage possesses 10 species, 9 of which are confined to it, while the tenth extends up into the next stage, the Toarcian (Upper Lias shale), which, however, contains only 3 species in all. The species just referred to (*Rhabdocidaris horrida*) also passes into the Bajocian (Inferior Oolite) stage, in which the

number of Cidaridæ is very considerable, 24 French species being recorded by M. Cotteau. Of these, 19 are peculiar to the stage; 1, as already stated, is of older date; 4 pass into the next stage; and one of these (*Rhabdocidaris copeoides*) extends up through the two subsequent stages.

In the Bathonian (Great Oolite) we have 20 species, 13 of which are peculiar, 4 had previously appeared, and 5 extend up into higher deposits; 3 of them, however, do not occur in the next following stage, but only in the one above it. The Callovian contains only 6 species, 4 of which are peculiar, and 2 extend up into the succeeding stage, 1 of them belonging also to that below. The Oxfordian, including therein the zone of *Ammonites tenuilobatus*, has 24 species, 4 of which had already made their appearance in the Bathonian, while 7 others extend up into the Corallian, and one of them even into the Kimmeridgian stage.

The family attains its maximum in the Corallian stage, from which M. Cotteau records 38 species, 29 of which are peculiar to this series of deposits. Seven species, as already stated, come up from the Oxfordian, while 3 recur in the next stage, the Kimmeridgian, which, however, has altogether only 9 species. The Portlandian has only a single peculiar species.

M. Cotteau sums up his results as follows:—"Of 121 species of Cidaridæ which were developed in France during the period of the Jurassic formation, 104 are, as at present known, peculiar to the stages in which they are found, and only 17 occur in more than one stage.

"The three genera *Cidaris*, *Rhabdocidaris*, and *Diplocidaris* have each a different origin and destiny.

"The genus *Cidaris*, including the greatest number of species, is of all genera of Echinida the one that has persisted longest. It makes its appearance in the deposits of the Carboniferous formation; from this period it multiplies its species in all the stages of the Jurassic, Cretaceous, and Tertiary formations; and at the present day it still possesses representatives in most of our seas. Notwithstanding this long duration, from its first appearance to the present epoch it has undergone in its general characters only unimportant modifications, which often render it difficult to distinguish the species.

"The genera *Rhabdocidaris* and *Diplocidaris* have been separated from *Cidaris*. The former began to appear in the Liassic stage, and attains its maximum of development during the Jurassic epoch; it likewise exists in the Cretaceous and Tertiary formations and at the present epoch, but is much rarer. The second genus, *Diplocidaris*, is peculiar to the Jurassic formation, and indeed does not exist even in its last stages.

"Over and above the 121 species of Jurassic Cidaridæ described and figured in the 'Paléontologie Française,' the genus *Cidaris* has furnished us with 47 species, 44 of which are foreign to our country; the genus *Rhabdocidaris* with 10, and *Diplocidaris* with 3 species foreign to France; which raises the number of species of Jurassic Cidaridæ that we know at present to 181."—*Bull. Soc. Géol. France*, 3me sér. tom. vii. p. 246.